

Programm-Code für die Formelberechnung

(in der Programmiersprache BlitzMax <http://www.blitzmax.com>)

Hier die berühmte Gleichung fürs Apfelmännchen
(bei Mandelbrot noch ohne param bzw. mit param=0):

NoOfFormula=1000

```
' *****  
'NoOfFormula=1000 Apfelmännchen  $Z=Z^2+C$ ,  $z=x+iy$   
  
Local zx1:Double, zy1:Double, zx2:Double, zy2:Double  
  
' Zwilling 1:  
zx1 = x  
zy1 = y  
x = zx1*zx1 - zy1*zy1 + Cx + param*p  
y = 2.0*zx1*zy1 + Cy + param*t  
  
' Zwilling 2:  
If twin Then  
zx2 = p  
zy2 = t  
p = zx2*zx2-zy2*zy2 + Cx - param*zx1  
t = 2.0*zx2*zy2 + Cy - param*zy1  
Else  
p = x  
t = y  
EndIf  
' *****  
' *****
```

Der Rest ist überall gleich.
Noch einfacher das ‚Auge‘:

NoOfFormula=1001

```
' *****  
'NoOfFormula=1001 Auge  $Z=Z*(Z^*)+C$  mit  $Z^*=x-iy$   
Local zx1:Double, zy1:Double, zx2:Double, zy2:Double  
  
' Zwilling 1:  
zx1 = x  
zy1 = y  
x = zx1*zx1 + zy1*zy1 + Cx + param*p  
y = Cy + param*t  
  
' Zwilling 2:  
If twin Then  
zx2 = p  
zy2 = t  
p = zx2*zx2 + zy2*zy2 + Cx - param*zx1  
t = Cy - param*zy1  
Else  
p = x  
t = y  
EndIf  
' *****  
' *****
```

NoOfFormula=149

```
' ***** Z=Z^Z-1
  ' fest drin: Const RADDEGREE:Double = 180.0 / Pi

Local rq:Double, x2:Double, y2:Double
Local noerr:Int, r:Double, f:Double, r1:Double, f1:Double
Local zx1:Double, zy1:Double, zx2:Double, zy2:Double

'Zwilling1:

  r1 = Sqr(x*x+y*y)
  f1 = ATan2(y,x)/RADDEGREE
  noerr = true
  If (r1 < 1E-300) Then noerr = false

  If (noerr) Then
    r = r1^x * Exp(-f1 * y)
    f = f1 * x + y * Log(r1)
    zx1 = r * Cos(f*RADDEGREE)
    zy1 = r * Sin(f*RADDEGREE)
  EndIf

  zx1 = zx1 + Cx + ParamA*p
  zy1 = zy1 + Cy - ParamA*t

'Zwilling2:

  r1 = Sqr(p*p+t*t)
  f1 = ATan2(p,t)/RADDEGREE

  noerr = true;
  If (r1 < 1E-300) Then noerr = false

  If (noerr) Then
    r = r1^p * Exp(-f1 * t)
    f = f1 * p + t * Log(r1)
    zx2 = r * Cos(f*RADDEGREE);
    zy2 = r * Sin(f*RADDEGREE)
  EndIf

  p = zx2 + Cx - ParamA*x
  t = zy2 + Cy + ParamA*y

  x = zx1;
  y = zy1;

' *****
' *****
```

NoOfFormula=151

```
*****
' Z=Z^Z + C
Local rq:Double, x2:Double, y2:Double
Local noerr:Int, r:Double, f:Double, r1:Double, f1:Double, zx1:Double, zy1:Double,
zx2:Double, zy2:Double

'Zwilling1:

    r1 = Sqr(x*x+y*y)
    f1 = ATan2(y,x)/RADDEGREE

    noerr = true
    If (r1 < 1E-300) Then noerr = false

    if (r1 < 1) Then
        x = 0; y = 0; zx1=0; zy1=0; noerr = false
    EndIf

    If (noerr) Then
        r = r1^x * Exp(-f1 * y)
        f = f1 * x + y * Log(r1)
        zx1 = r * Cos(f*RADDEGREE)
        zy1 = r * Sin(f*RADDEGREE)
    EndIf

    zx1 = zx1 + Cx + ParamA*p
    zy1 = zy1 + Cy - ParamA*t

'Zwilling2:

    If twin Then

        r1 = Sqr(p*p+t*t)
        f1 = ATan2(p,t)/RADDEGREE

        noerr = true;
        If (r1 < 1E-300) Then noerr = false

        If (r1 < 1) Then
            x = 0; y = 0; zx1=0; zy1=0; noerr = false
        EndIf

        If (noerr) Then
            r = r1^p * Exp(-f1 * t)
            f = f1 * p + t * Log(r1)
            zx2 = r * Cos(f*RADDEGREE);
            zy2 = r * Sin(f*RADDEGREE)
        EndIf

        p = zx2 + Cx - ParamA*x
        t = zy2 + Cy + ParamA*y
    EndIf

    x = zx1
    y = zy1

*****
*****
```

NoOfFormula=152

```
' *****
'Vierpolgleichung Z = (Z+C)/(1+C*Z^3)
'Stern zum Schmetterling (Film Landung der Engel mit JuliaSet=0)

Local a:Double,b:Double,qx:Double,qy:Double,q3x:Double,q3y:Double
Local u:Double,v:Double,d:Double,e:Double,fsb:Double
Local xrett:Double, yrett:Double

' Zwilling 1:

a = Cx * (1 + param * p)
b = Cy * (1 - param * t)
qx = x * x - y * y
qy = 2 * x * y
q3x = qx * x - qy * y
q3y = qx * y + qy * x
u = x + a
v = y + b
d = a * q3x - b * q3y + 1
e = a * q3y + b * q3x
fsb = d * d + e * e
If (fsb < 1E-10) idivNull=True; abbr=True

xrett = (u * d + v * e) / fsb
yrett = (v * d - u * e) / fsb

' Zwilling 2:

If twin Then

  a = Cp * (1 + param * x)
  b = Ct * (1 - param * y)
  x = p
  y = t
  qx = x * x - y * y
  qy = 2 * x * y
  q3x = qx * x - qy * y
  q3y = qx * y + qy * x
  u = x + a
  v = y + b
  d = a * q3x - b * q3y + 1
  e = a * q3y + b * q3x
  fsb = d * d + e * e
  If (fsb < 1E-10) idivNull=True; abbr=True
  p = (u * d + v * e) / fsb
  t = (v * d - u * e) / fsb

Else
  p = x
  t = y

EndIf

x = xrett
y = yrett

' *****
' *****
```

NoOfFormula=201

```
' *****
' Klinge, Tropfen, Spirale, Batman  Z = (Z+C)/(1+C*Z^2)

Local h1:Double,h2:Double
Local a:Double,b:Double,qx:Double,qy:Double
Local q3x:Double,q3y:Double,u:Double,v:Double,d:Double,e:Double
Local fsb:Double,xrett:Double,yrett:Double

' *****
' Zwilling 1:

    h1 = 1 + param * p
    h2 =      param * t
    a = Cx * h1 - Cy * h2
    b = Cy * h1 + Cx * h2
    qx = x * x - y * y
    qy = 2 * x * y
    u = x + a
    v = y + b
    d = a * qx - b * qy + 1
    e = a * qy + b * qx
    fsb = d * d + e * e
    If (fsb < 1.0E-10) Then idivNull=True; abbr=True
    xrett = (u * d + v * e) / fsb
    yrett = (v * d - u * e) / fsb

' Zwilling 2:

    If twin Then

        h1 = 1 - param * x
        h2 =      - param * y
        a = Cp * h1 - Ct * h2
        b = Ct * h1 + Cp * h2
        x = p
        y = t
        qx = x * x - y * y
        qy = 2 * x * y
        u = x + a
        v = y + b
        d = a * qx - b * qy + 1
        e = a * qy + b * qx
        fsb = d * d + e * e
        If (fsb < 1.0E-10) Then idivNull=True; abbr=True

        p = (u * d + v * e) / fsb
        t = (v * d - u * e) / fsb

    Else

        p = x
        t = y

    EndIf

    x = xrett
    y = yrett

' *****
' *****
```

NoOfFormula=202

```
' *****
' sqrt(1) 6-dim      Hier Newton mit 4 Dimensionen,
' bei 203 nur noch 2 Dim., 205 zusätzlich Zwilling

Local p2:Double, t2:Double, pt6:Double, q3:Double, p3:Double, t3:Double
Local pqt3:Double, ptq3:Double, p6:Double, t6:Double, fsb:Double
Local fdx:Double, fdy:Double, fdp:Double, fdt:Double
Local a:Double, b:Double, c:Double, d:Double, e:Double
Local f:Double, gz:Double, h:Double, x2:Double, y2:Double
Local x3:Double, y3:Double, qd:Double, xy6:Double
Local ga:Double, gb:Double, gc:Double, gd:Double, ge:Double, gf:Double

genau = 0.0001

pt6 = 6.0 * p * t
p2 = p * p
t2 = t * t
q3 = 3.0 * (p2-t2)
p3 = p * p2
t3 = t * t2
pqt3 = 3.0 * p2 * t
ptq3 = 3.0 * p * t2
p6 = 6.0 * p;
t6 = 6.0 * t

x2 = x * x
y2 = y * y
x3 = x * x2
y3 = y * y2
qd = (x2-y2) * 3.0
xy6 = x * y * 6.0

a = x3 - 3.0*x*y2 + y*q3 + x*pt6 + Cx
b = 3.0*y*x2 - y3 - x*q3 + y*pt6 + Cy
c = p*qd - xy6*t + pqt3 - t3 + Cp
d = t*qd + xy6*p + ptq3 - p3 + Ct
e = qd + pt6
f = xy6 - q3
gz = x*p6 - y*t6
h = y*p6 + x*t6
ga = a*e - b*f - c*h - d*gz
gb = a*f + b*e + c*gz - d*h
gc = c*e - f*d - a*gz + b*h
gd = e*d + f*c - a*h - b*gz
ge = e*e - f*f - 2.0*gz*h
gf = gz*gz - h*h + 2.0*e*f
fsb = ge*ge + gf*gf
If (fsb < 1.0E-10) idivNull=True; abbr=True
fdx = (ga*ge + gb*gf)/fsb
fdy = (gb*ge - ga*gf)/fsb
fdp = (gc*ge + gd*gf)/fsb
fdt = (gd*ge - gc*gf)/fsb
x = x - fdx/(param+1)
y = y - fdy/(param*1.5+1)
p = p - fdp/(param*2+1)      'früher: param/2*fdp;
t = t - fdt/(param*3+1)    'früher: param/3*fdt;

' *****
' *****
```

NoOfFormula=203

```
' *****
' Blume sqrt(1) 2-dim
' Achtung! Es gibt hier 3 Varianten mit unterschiedlichen Startwerten
' siehe 2031 und 2032

Local p2:Double, t2:Double, pt6:Double, q3:Double, p3:Double, t3:Double
Local pqt3:Double, ptq3:Double, p6:Double, t6:Double, fsb:Double
Local fdx:Double, fdy:Double, fdp:Double, fdt:Double
Local a:Double, b:Double, c:Double, d:Double, e:Double
Local f:Double, gz:Double, h:Double, x2:Double, y2:Double
Local x3:Double, y3:Double, qd:Double, xy6:Double
Local ga:Double, gb:Double, gc:Double, gd:Double, ge:Double, gf:Double

      ' Achtung! hier kein Zwilling . param hat andere Bedeutung

pt6 = 6.0 * p * t
p2 = p * p
t2 = t * t
q3 = 3.0 * (p2-t2)
p3 = p * p2
t3 = t * t2
pqt3 = 3.0 * p2 * t
ptq3 = 3.0 * p * t2
p6 = 6.0 * p
t6 = 6.0 * t

x2 = x * x
y2 = y * y
x3 = x * x2
y3 = y * y2
qd = (x2-y2) * 3.0
xy6 = x * y * 6.0

a = x3 - 3.0*x*y2 + y*q3 + x*pt6 + Cx
b = 3.0*y*x2 - y3 - x*q3 + y*pt6 + Cy
c = p*qd - xy6*t + pqt3 - t3 + Cp
d = t*qd + xy6*p + ptq3 - p3 + Ct
e = qd + pt6
f = xy6 - q3
gz = x*p6 - y*t6      'gz statt g wegen      graphics g
h = y*p6 + x*t6
ga = a*e - b*f - c*h - d*gz
gb = a*f + b*e + c*gz - d*h
      'gc = c*e - f*d - a*gz + b*h
      'gd = e*d + f*c - a*h - b*gz
ge = e*e - f*f - 2.0*gz*h
gf = gz*gz - h*h + 2.0*e*f
fsb = ge*ge + gf*gf
If fsb < 1.0E-10 Then idivNull=True; abbr=True ' Abbruch wegen Division durch Null
fdx = (ga*ge + gb*gf)/fsb
fdy = (gb*ge - ga*gf)/fsb
      'fdp = (gc*ge + gd*gf)/fsb
      'fdt = (gd*ge - gc*gf)/fsb
x = x - fdx/(param +1)
y = y - fdy/(param +1)
      'p = p - fdp/(param*2+1); ' param/2*fdp;
      't = t - fdt/(param*3+1); ' param/3*fdt;

' *****
' *****
```

NoOfFormula=206

```
' ***** Schädel  $Z=Z^{(Z^*)-1}$ 
' Const RADDEGREE:Double = 180.0 / Pi
Local noerr:Int, r:Double, f:Double, r1:Double, f1:Double
Local zx1:Double, zy1:Double, zx2:Double, zy2:Double

' Zwilling 1:
    zx1 = x
    zy1 = y
    xalt = x
    yalt = y
    r1 = Sqr(x*x+y*y)
    r = r1
    f1 = - ATan2(y,x)/RADDEGREE
    noerr = True
    If r1 < 1E-290 Then noerr = False

    If noerr Then
        r = r1^x * Exp(-f1 * y)
        If (r > 1E+290) Then noerr = False
    EndIf
    If noerr Then
        f = f1 * x + y * Log(r1)
        zx1 = r * Cos(f*RADDEGREE)
        zy1 = r * Sin(f*RADDEGREE)
    EndIf
    zx1 = zx1 + Cx + param * p
    zy1 = zy1 + Cy + param * t

' Zwilling 2:
    If twin Then
        zx2 = p
        zy2 = t
        x = p
        y = t
        r1 = Sqr(x*x+y*y)
        r = r1
        f1 = - ATan2(y,x)/RADDEGREE
        noerr = True
        If r1 < 1E-290 Then noerr = False
        If noerr Then
            r = r1^x * Exp(-f1 * y)
            If (r > 1E+290) noerr = False;
        EndIf
        If noerr Then
            f = f1 * x + y * Log(r1)
            zx2 = r * Cos(f*RADDEGREE)
            zy2 = r * Sin(f*RADDEGREE)
        EndIf
        zx2 = zx2 + Cx - param * xalt
        zy2 = zy2 + Cy - param * yalt
        p = zx2
        t = zy2
    Else
        p = zx1
        t = zy1
    EndIf

    x = zx1
    y = zy1

' *****
' *****
```


Startwerte allgemeiner Fall für fast alle Gleichungen

' für alle Programm ohne gesonderte Startwerte
verwendbare Variablen, sind so definiert (andernfalls neue definieren):

```
'Local twin:Int, juliaset:Int  
'Local param:Double, Param1:Double usw. bis Param10 und ParamA  
'param = ParamA  
'twin = 1; If ParamA = 0.0 Then twin = 0
```

' *****

```
If juliaset = 1 Then  
  x = drehx; y = drehy; p = x; t = y  
  xm[1] = x; ym[1] = y; pm[1] = p; tm[1] = t  
Else  
  Cx = drehx; Cy = drehy; Cp = Cx; Ct = Cy  
  x = 0; y = 0; p = x; t = y  
  xm[1] = 0; ym[1] = 0; pm[1] = 0; tm[1] = 0  
EndIf
```

' *****

' *****

Startwerte von NoOfFormula=149

' *****

```
If juliaset Then  
  x = drehx; y = drehy; p = x; t = y  
  xm[1] = x; ym[1] = y; pm[1] = p; tm[1] = t  
Else  
  Cx = drehx; Cy = drehy; Cp = Cx; Ct = Cy  
  x = drehx; y = drehy; p = x; t = y  
  xm[1] = 0; ym[1] = 0; pm[1] = 0; tm[1] = 0  
EndIf
```

' *****

' *****

Startwerte von NoOfFormula=2032

' *****

' Blume sqrt(1) 2-dim **Gleichung 203**
' Flügelblume/Ringblume

```
If juliaset Then  
  x = drehx; y = drehy; p = drehp; t = dreht  
  xm[1] = x; ym[1] = y; pm[1] = p; tm[1] = t  
Else  
  Cx = 1; Cy = 1; Cp = 0; Ct = 0  
  x = 0.7937005; y = -x; p = drehp; t = dreht  
  xm[1] = 0; ym[1] = 0; pm[1] = 0; tm[1] = 0  
EndIf
```

' *****

' *****

Startwerte von NoOfFormula=2031

```
' *****  
' Blume sqrt(1) 2-dim Gleichung 203  
' Drehblume  
  If juliaset Then  
    x = drehx; y = drehy; p = drehp; t = dreht  
    xm[1] = x; ym[1] = y; pm[1] = p; tm[1] = t  
  
  Else  
    Cx = 1; Cy = 1; Cp = 1; Ct = -1  
    x = drehx; y = drehy; p = drehp; t = dreht  
    xm[1] = 0; ym[1] = 0; pm[1] = 0; tm[1] = 0  
  EndIf  
  
' *****  
' *****
```